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Specific Aims

The main thrust of our studies has been focused on studying the effects of buoyancy on fluid flows and turbulence, having direct significance to geophysical flows, in particular keeping in mind the effects on the mixing of scalars, such as salinity and temperature.

Results

The most significant results achieved were the following;

- Post-Doctoral Researcher Sigurdur Thoroddsen has completed a study of the effects of mean strain on stably stratified grid turbulence. This was studied in our thermally stratified wind tunnel by passing a turbulent field through a contraction in the vertical direction, see Thoroddsen & Van Atta (1993). The competition between the increased stratification strength, as the flow passes through the contraction and the stretching of streamwise vorticity lead. to strong reversal of buoyancy flux and strong fossilization of the turbulence.

- Dr. Paul Piccirillo has fininshed his Doctoral degree and in the process completed a study of thermally stratified turbulent uniform mean shear flow. This new wind tunnel was designed and constructed by him over a few years, with the support of the agency. He collected data for numerous Richardson numbers as well as many turbulent Reynolds numbers, since the study was partly aimed at identifying the dependence of critical Richardson number (where rms velocity fluctuations stay constant) on the turbulent Reynolds number. His experiments have also confirmed some phenomena previously observed in numerical simulations and invalidated others.

- Dr. Dave Schowalter has just completed the defense of his dissertation, on the effects of baroclinic generation of vorticity on the streamwise vortices in the plane mixing layer, in the presence of stratification. This study has shown conclusively that the baroclinic generation of vorticity is instrumental in changing the streamwise vortex structure, which in the non-stratified case is closely related with the mixing transition.

- Current focus of activity in the laboratory is on the application of *Particle Image Velocimetry* to the study of stratified flows. We (Thoroddsen & Van Atta) are pursuing a study of the breakdown of a vortex ring traveling horizontally in a stratified water tank. We are using multi-camera video system and pulsed lasers to follow the break-down of the vortex and its ability to mix the fluid.

Publications

- 1. Thoroddsen, S.T. & C.W. Van Atta, **Experiments on the Effects of a Vertical Contraction on the Evolution of Stably Stratified Turbulence**, submitted to *J. Fluid Mech.*
- 2. Piccirillo, P. & Van Atta, C. W., **Experiments on Uniform Mean Shear Stratified Turbulence**, Paper being written for *J. Fluid Mech.*
- 3. Schowalter, D. G., Van Atta, C. W. & Lasheras, J. C. **A Study of Streamwise Vortex Structure in a Stratifed Shear Layer**, Submitted to *J. Fluid Mech.*